

JRA, INC.
POST-HYDROLYSIS SOLIDS ANALYSIS
DECEMBER 9, 2014

REPORT OF ANALYSIS

CLIENT: Fiberight
 ATTN: Jose Garcia
 ADDRESS: 835 Industrial Park Drive
 Lawrenceville, VA 23868
 PHONE: 434-848-8026
 FAX:

SAMPLE COLLECTED BY: CLIENT
 GRAB COLLECTION:
 Date: 12/9/2014 Time: 1400
 COMPOSITE COLLECTION:
 Start Date: Time:
 End Date: Time:



Special Notes: RE: PHS002

PICK UP BY: UPS
 SAMPLE RECEIPT:
 Date: 12/10/2014 Time: 0910
 NUMBER OF CONTAINERS: 1
 SAMPLE CONDITION: ☒ Good ☐ Other (See C-O-C)
 REPORT NO: 14-19038 16:03

SAMPLE ID: PHS BUNKER
 SAMPLE NO: 14-19038

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Mercury	7471B	0.025	0.272	mg/kg	PEJ	12/19/14	1520
Total Aluminum	6010C	13.4	2696	mg/Kg	EFA	12/18/14	1120
Total Antimony	6010C	1.34	1.56	mg/Kg	EFA	12/18/14	1120
Total Arsenic	6010C	1.34	< 1.34	mg/Kg	EFA	12/18/14	1120
Total Barium	6010C	1.34	47.4	mg/Kg	EFA	12/18/14	1120
Beryllium	6010C	0.134	< 0.134	mg/Kg	EFA	12/18/14	1120
Total Boron	6010C	13.4	< 13.4	mg/kg	EFA	12/19/14	1356
Total Cadmium	6010C	0.134	0.387	mg/Kg	EFA	12/19/14	1126
Total Calcium	6010C	13.4	5049	mg/Kg	EFA	12/18/14	1323
Total Chromium	6010C	0.269	23.6	mg/Kg	EFA	12/18/14	1120
Total Cobalt	6010C	1.34	< 1.34	mg/Kg	EFA	12/18/14	1120
Total Copper	6010C	0.538	42.3	mg/Kg	EFA	12/18/14	1120
Total Iron	6010C	2.69	1684	mg/Kg	EFA	12/18/14	1120
Total Lead	6010C	1.34	39.5	mg/Kg	EFA	12/18/14	1120
Total Magnesium	6010C	13.4	465	mg/Kg	EFA	12/18/14	1120
Total Manganese	6010C	1.34	55.1	mg/Kg	EFA	12/18/14	1120
Total Molybdenum	6010C	1.34	4.77	mg/Kg	EFA	12/18/14	1120
Total Nickel	6010C	1.34	11.0	mg/Kg	EFA	12/18/14	1120
Total Potassium	6010C	13.4	822	mg/Kg	EFA	12/18/14	1323
Total Strontium	6010C	1.34	12.1	mg/Kg	EFA	12/18/14	1120
Total Silver	6010C	0.269	0.270	mg/Kg	EFA	12/17/14	1619
Total Sodium	6010C	13.4	656	mg/Kg	EFA	12/18/14	1120
Total Selenium	6010C	1.34	1.84	mg/Kg	EFA	12/18/14	1120
Total Thallium	6010C	1.34	< 1.34	mg/Kg	EFA	12/18/14	1120

James R. Reed & Associates
 770 Pilot House Drive, Newport News, VA 23606
 (757) 873-4703 • Fax: (757) 873-1498

VELAP# 460013
 EPA# VA00015



REPORT OF ANALYSIS

SAMPLE ID: PHS BUNKER

SAMPLE NO: 14-19038

Parameter	Method Number	JRA QL	Result	Unit	Analyst	Date	Time
Total Tin	6010C	1.34	40.9	mg/Kg	EFA	12/18/14	1323
Total Titanium	6010C	1.34	37.8	mg/Kg	EFA	12/18/14	1120
Total Vanadium	6010C	1.34	3.62	mg/Kg	EFA	12/18/14	1120
Total Zinc	6010C	1.34	204	mg/Kg	EFA	12/18/14	1120

NOTES:

JRA Quantification Level is the concentration of the lowest calibration standard above zero with a reliable signal.

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The results on this report relate only to the sample(s) provided for analysis.

Results conform to NELAC standards, where applicable, unless otherwise indicated.

Results in mg/kg are reported on a dry weight basis.

Authorized By: Elaine Claiborne

Elaine Claiborne, Laboratory Director

Date: 22-Dec-14

James R. Reed & Associates

770 Pilot House Drive, Newport News, VA 23606

(757) 873-4703 • Fax: (757) 873-1498

VELAP# 460013

EPA# VA00015



TECHNICAL LABS
POST-HYDROLYSIS SOLIDS ANALYSIS
OCTOBER 30, 2015

TECHNICAL LABORATORIES, INC.

LEWIS E. CAIN
President

3815 ROSSVILLE BLVD.
CHATTANOOGA, TENNESSEE 37407

(423) 265-4533

ACCOUNT NO. 5790-001
DATE DECEMBER 07, 2015
RECEIVED FROM GLOBAL ENERGY SOLUTIONS, INC., 40 SHUMAN BLVD., SUITE 305,
MR. GREG SMITH NAPERVILLE, IL 60553
RECEIVED DATE 10/30/15
MATERIAL PELLETS
MARKED FIBERIGHT, LLC., PURCHASE ORDER NO. 3161
LABORATORY NO. 531,421

	AS ANALYZED	DRY BASIS	ASH & MOISTURE FREE	AS RECEIVED
Moisture	9.57 %	0.00 %	0.00 %	9.57 %
Volatile	62.90	69.56	83.56	62.90
Fixed Carbon	12.38	13.69	16.44	12.38
Ash	15.15	16.75	0.00	15.15
Sulfur	0.65	0.72	0.86	0.65
Btu	8,069	8,923	10,718	8,069
Chlorine, dry basis				0.10 %
<u>FUSIBILITY OF ASH (Reducing Atmosphere)</u>				
Initial Deformation Temperature			2080 °F	
Softening Temperature			2130 °F	
Hemispherical Temperature			2150 °F	
Fluid Temperature			2250 °F	

This is a corrected report issued December 18, 2015.

TECHNICAL LABORATORIES, INC.

LEWIS E. CAIN
President

TECHNICAL LABORATORIES, INC.

LEWIS E. CAIN
President

3815 ROSSVILLE BLVD.
CHATTANOOGA, TENNESSEE 37407

(423) 265-4533

ACCOUNT NO. 5790-001

DATE DECEMBER 31, 2015

RECEIVED FROM GLOBAL ENERGY SOLUTIONS, INC., 40 SHUMAN BLVD., SUITE 305,
MR. GREG SMITH NAPERVILLE, IL 60553

RECEIVED DATE 10/30/15

MATERIAL PELLETS

MARKED FIBERIGHT, LLC., PURCHASE ORDER NO. 3161

LABORATORY NO. 531,421-A

MINERAL ANALYSIS ON ASH

Antimony ppm	0.1
Arsenic ppm	<0.1
Beryllium ppm	0.1
Cadmium ppm	<0.1
Chromium ppm	0.5
Cobalt ppm	<0.1
Lead ppm	10
Manganese ppm	1.0
Mercury ppm	1.9
Nickel ppm	1.4
Selenium ppm	<0.1
Fluoride ppm	36

TECHNICAL LABORATORIES, INC.

LEWIS E. CAIN

President

ibc

Kyle Sullivan

From: Alan Iantosca <aiantosca@fiberight.com>
Sent: Tuesday, February 23, 2016 12:51 PM
To: Kyle Sullivan
Cc: 'Alan Iantosca'
Subject: FW: conversions

FYI. Please see metals in fuel below.

Alan P Iantosca | VP Engineering and Projects
Fiberight LLC | PO Box 21171 Catonsville, MD 21228
Phone: (908) 656-4485 | Email : aiantosca@fiberight.com



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-----Original Message-----

From: lewis@technicallabschatt.com [<mailto:lewis@technicallabschatt.com>]
Sent: Tuesday, February 23, 2016 12:19 PM
To: Alan Iantosca
Subject: Fwd: conversions

----- Forwarded Message -----

From: lewis@technicallabschatt.com
To: alantosca@fiberight.com
Cc: jimalwin@sbcglobal.net
Sent: Tuesday, February 23, 2016 12:15:08 PM
Subject: conversions

The conversion from ppm of ash to ppm dry basis is:

$$C = \frac{AD}{100}$$

C= ppm dry basis
A= ppm of ash
B= %dry ash

antimony 0.02 ppm dry basis of original material
arsenic <0.02
beryllium 0.02
cadmium <0.02
chromium 0.08
lead 1.6
manganese 0.16

mercury	0.31
nickel	0.23
selenium	<0.02
fluoride	6.0

TECHNICAL LABS
POST-HYDROLYSIS SOLIDS ANALYSIS
DECEMBER 18, 2015

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BOULEVARD
CHATTANOOGA, TENNESSEE 37405

(423) 265-4533

LEWIS E. CAIN
President

ACCOUNT NO. 5790-001 DATE DECEMBER 18, 2014

RECEIVED FROM GLOBAL ENERGY SOLUTIONS, INC., 40 SHUMAN BLVD., SUITE 305,
MR. GREG SMITH NAPERVILLE, IL 60553

RECEIVED DATE 11/14/14

MATERIAL SLUDGE CAKE

MARKED FIBERIGHT, LLC., PURCHASE ORDER NO. 3161

LABORATORY NO. 529,001

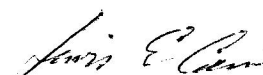
	AS ANALYZED	DRY BASIS	ASH & MOISTURE FREE	AS RECEIVED
Moisture	69.54 %	0.00 %	0.00 %	69.54 %
Volatile	26.04	85.48	88.82	26.04
Fixed Carbon	3.27	10.76	11.18	3.27
Ash	1.15	3.76	0.00	1.15
Sulfur	0.02	0.07	0.07	0.02
Btu	2,264	7,434	7,724	2,264

Chlorine, dry basis 0.03 %

FUSIBILITY OF ASH (Reducing Atmosphere)

Initial Deformation Temperature	2190 °F
Softening Temperature	2380 °F
Hemispherical Temperature	2430 °F
Fluid Temperature	2480 °F

TECHNICAL LABORATORIES, INC.


LEWIS E. CAIN
President

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BOULEVARD
CHATTANOOGA, TENNESSEE 37405

LEWIS E. CAIN
President

(423) 265-4533

ACCOUNT NO. 5790-001 DATE DECEMBER 18, 2014

RECEIVED FROM GLOBAL ENERGY SOLUTIONS, INC., 40 SHUMAN BLVD., SUITE 305,
MR. GREG SMITH NAPERVILLE, IL 60553

RECEIVED DATE 11/14/14

MATERIAL SLUDGE CAKE

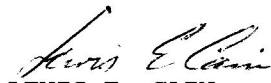
MARKED FIBERIGHT, LLC., PURCHASE ORDER NO. 3161

LABORATORY NO. 529,001-1

ULTIMATE ANALYSIS (Dry Basis)

Ash %	3.76
Hydrogen %	5.87
Carbon %	47.98
Nitrogen %	0.57
Sulfur %	0.07
Oxygen %	41.75

TECHNICAL LABORATORIES, INC.



LEWIS E. CAIN
President

ibc

TECHNICAL LABORATORIES, INC.

515 CHEROKEE BOULEVARD
CHATTANOOGA, TENNESSEE 37405

LEWIS E. CAIN
President

(423) 265-4533

ACCOUNT NO. 5790-001
DATE DECEMBER 31, 2014
RECEIVED FROM GLOBAL ENERGY SOLUTIONS, INC., 40 SHUMAN BLVD., SUITE 305,
MR. GREG SMITH NAPERVILLE, IL 60553
RECEIVED DATE 11/14/14
MATERIAL SLUDGE CAKE
MARKED FIBERIGHT, LLC., PURCHASE ORDER NO. 3161
LABORATORY NO. 529,001-2

Antimony ppm	0.2
Arsenic ppm	0.7
Beryllium ppm	<0.1
Cadmium ppm	<0.1
Chromium ppm	2.5
Cobalt ppm	0.1
Lead ppm	5.0
Manganese ppm	9.8
Mercury ppm	0.03
Nickel ppm	2.1
Selenium ppm	<0.1
Fluoride ppm	75

TECHNICAL LABORATORIES, INC.



LEWIS E. CAIN
President

ibc

HAZEN RESEARCH, INC.
POST-HYDROLYSIS SOLIDS ANALYSIS
FEBRUARY 3, 2016

**Hazen Research, Inc.**

4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Date January 22 2016
HRI Project 009-1041
HRI Series No. A28/16
Date Rec'd. 01/13/16
Cust. P.O.#

Globals Energy Solutions, Inc.
James Alwin
One Energy Center, 40 Shuman Blvd, Suite
Naperville, Illinois 60563

Sample Identification
Fiberight PHS Briquettes

Reporting
Basis >

As Rec'd

Dry

Air Dry

Proximate (%)

Moisture	5.90	0.00	5.90
Ash	15.71	16.70	15.71
Volatile	65.27	69.36	65.27
Fixed C	13.12	13.94	13.12
Total	100.00	100.00	100.00
Sulfur	0.223	0.237	0.223
Btu/lb (HHV)	7533	8005	7533
Btu/lb (LHV)	6995	7498	
MMF Btu/lb	9072	9767	
MAF Btu/lb		9609	

Ultimate (%)

Moisture	5.90	0.00	5.90
Carbon	44.75	47.56	44.75
Hydrogen	5.15	5.47	5.15
Nitrogen	1.45	1.54	1.45
Sulfur	0.22	0.24	0.22
Ash	15.71	16.70	15.71
Oxygen*	26.82	28.49	26.82
Total	100.00	100.00	100.00
Chlorine**	0.130	0.138	0.130

Air Dry Loss (%)

Forms of Sulfur, as S, (%)

Sulfate
Pyritic
Organic

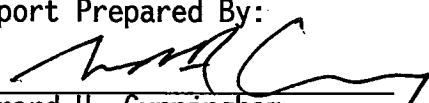
Total	0.22	0.24
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Water Soluble Alkalies (%)

Na₂O
K₂O

Lb. Alkali Oxide/MM Btu=
Lb. Ash/MM Btu= 20.86
Lb. SO₂/MM Btu= 0.59
Lb. Cl/MM Btu= 0.17
As Rec'd. Sp.Gr.=
Free Swelling Index=
F-Factor(dry), DSCF/MM Btu= 9,984

Report Prepared By:


Gerard H. Cunningham
Fuels Laboratory Supervisor

* Oxygen by Difference.

** Not usually reported as part of the ultimate analysis.

**Hazen Research, Inc.**

4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

Global Energy Solutions, LLC
Jim Alwin
One Energy Center, 40 Shuman Blvd., Ste. 305
Naperville, Illinois 60563

Date: February 3, 2016
Project No: 009-1041
Control No: A28/16
Received: 01/13/16

Sample Number: A28/16-1

Sample Identification: Fiberright PHS Briquettes

Residual Moisture, %	5.90
Ash (As Received Basis), %	15.71
Ash (Dry Basis), %	16.70
Arsenic (As Received Basis), mg/kg	1.11
Arsenic (Dry Basis), mg/kg	1.18
Fluorine (As Received Basis), %	
Fluorine (Dry Basis), %	
Mercury (As Received Basis), mg/kg	0.35
Mercury (Dry Basis), mg/kg	0.37
Selenium (As Received Basis), mg/kg	3.72
Selenium, (Dry Basis), mg/kg	3.95

Metals in Ash

Antimony, mg/kg, mg/kg	261
Beryllium, mg/kg	<10
Cadmium, mg/kg	27
Chromium, mg/kg	567
Cobalt, mg/kg	75
Lead, mg/kg	4440
Manganese, mg/kg	1210
Nickel, mg/kg	424

Metals, Dry Whole Fuel Basis

Antimony, mg/kg, mg/kg	43.6
Beryllium, mg/kg	<2
Cadmium, mg/kg	4.5
Chromium, mg/kg	94.7
Cobalt, mg/kg	13
Lead, mg/kg	741
Manganese, mg/kg	202
Nickel, mg/kg	70.8

Note: The dry whole fuel values are calculated values.
The ash was prepared at 600 degrees Celsius.

By:


Gerard H. Cunningham
Fuel Laboratory Manager

**Hazen Research, Inc.**

4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE February 3, 2016
PROJ. # 009-1041
CTRL # A28/16
REC'D 01/13/16

Global Energy Solutions, LLC
Jim Alwin
One Energy Center, 40 Shuman Blvd., Ste. 305
Naperville, Illinois 60563

Fusion Temperature of Ash

Sample Number: A28/16-1
Sample Identification: Fiberight PHS Briquettes

Reducing Atmosphere (degrees F)


Initial Temperature	2040
Softening Temperature	2066
Hemispherical Temperature	2072
Fluid Temperature	2080

Oxidizing Atmosphere (degrees F)

Initial Temperature	2168
Softening Temperature	2181
Hemispherical Temperature	2188
Fluid Temperature	2195

The ash was prepared at 600 degrees Celsius.

By:


Gerard H. Cunningham
Fuel Laboratory Manager

ALS GROUP USA, CORP.
POST-HYDROLYSIS SOLIDS ANALYSIS
APRIL 15, 2016



Client: Fiberight
853 Industrial Park Dr.
Lawrenceville, VA 23868

Attn: Patrick Emerson
Project: 16 0408 - Fiberight

Date Received: 4/15/16

Certificate of Analysis

Sample ID:	Sample Date & Time		Lab #:	Moisture, Total	Volatile Matter		Fixed Carbon		Ash	
				wt%	D7582 Proximate by Automated TGA System					
					As Received wt%	Moist. Free wt%	As Received wt%	Moist. Free wt%	As Received wt%	Moist. Free wt%
cellulose briquettes	11/30/15	n/a	T1600588-001	5.76	62.93	66.78	14.95	15.87	16.36	17.36

ADDRESS 3860 S. Palo Verde Road, Suite 302, Tucson, AZ 85714
PHONE +1 520 573 1061
FAX +1 520 573 1063

Rpt-T1600588 Fiberight Emerson,
5/25/2016



Client: Fiberight
853 Industrial Park Dr.
Lawrenceville, VA 23868

Attn: Patrick Emerson
Project: 16 0408 - Fiberight

Date Received: 4/15/16

Certificate of Analysis

Sample ID:	Sample Date & Time:	Lab #:	Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur	Chlorine	Mercury	
			D5373			Calculated	D4239	5050/9056	D6722	
			Moist. Free wt%	Moist. Free wt%	Moist. Free wt%	Moist. Free wt%	Moist. Free wt%	Moist. Free mg/kg	Moist. Free ppb	
cellulose briquettes	11/30/15	n/a	T1600588-001	46.10	4.99	1.54	29.71	0.287	1,190	767

ADDRESS 3860 S. Palo Verde Road, Suite 302, Tucson, AZ 85714
PHONE +1 520 573 1061
FAX +1 520 573 1063

Rpt-T1600588 Fiberight Emerson,
5/25/2016



Client: Fiberight
853 Industrial Park Dr.
Lawrenceville, VA 23868

Attn: Patrick Emerson
Project: 16 0408 - Fiberight

Date Received: 4/15/16

Certificate of Analysis

Sample ID:	Sample Date & Time:	Lab#:		Heating Value				
				D5865				
				As Received BTU/lb	Moist. Free BTU/lb			
cellulose briquettes	11/30/15 n/a	T1600588-001		7,574	8,037			

Note:
Sample was air dried then ground to < 1 mm prior to analysis.

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Fiberight
Project: 16 0408 - Fiberight
Sample Matrix: Biosolids Solids

Sample Name: cellulose briquettes
Lab Code: T1600588-001

Service Request: T1600588
Date Collected: 11/30/15 00:00
Date Received: 04/15/16 11:03

Basis: As Received

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Q
Solids, Total	160.3 Modified	96	Percent	0.10	1	05/31/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Fiberight
Project: 16 0408 - Fiberight
Sample Matrix: Biosolids Solids
Sample Name: cellulose briquettes
Lab Code: T1600588-001

Service Request: T1600588
Date Collected: 11/30/15 00:00
Date Received: 04/15/16 11:03

Basis: Dry

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Antimony, Total	6010B	14.2	mg/Kg	1.1	1	04/22/16 21:11	04/21/16	
Arsenic, Total	6010B	3.5	mg/Kg	1.1	1	04/21/16 22:35	04/21/16	
Beryllium, Total	6010B	ND U	mg/Kg	0.43	1	04/21/16 22:35	04/21/16	
Cadmium, Total	6010B	5.83	mg/Kg	0.54	1	04/22/16 21:11	04/21/16	
Chromium, Total	6010B	75.8	mg/Kg	1.1	1	04/21/16 22:35	04/21/16	
Cobalt, Total	6010B	8.7	mg/Kg	1.1	1	04/22/16 21:11	04/21/16	
Lead, Total	6010B	1090	mg/Kg	1.1	1	04/21/16 22:35	04/21/16	
Manganese, Total	6010B	214	mg/Kg	1.1	1	04/21/16 22:35	04/21/16	
Nickel, Total	6010B	73.8	mg/Kg	1.1	1	04/21/16 22:35	04/21/16	
Selenium, Total	6010B	ND U	mg/Kg	1.1	1	04/21/16 22:35	04/21/16	

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client: Fiberight
Project: 16 0408 - Fiberight
Sample Matrix: Biosolids Solids

Sample Name: Method Blank
Lab Code: T1600588-MB

Service Request: T1600588
Date Collected: NA
Date Received: NA

Basis: Dry

Inorganic Parameters

Analyte Name	Analysis Method	Result	Units	MRL	Dil.	Date Analyzed	Date Extracted	Q
Antimony, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	
Arsenic, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	
Beryllium, Total	6010B	ND U	mg/Kg	0.20	1	04/21/16 20:53	04/21/16	
Cadmium, Total	6010B	ND U	mg/Kg	0.25	1	04/22/16 20:14	04/21/16	
Chromium, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	
Cobalt, Total	6010B	ND U	mg/Kg	0.50	1	04/22/16 20:14	04/21/16	
Lead, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	
Manganese, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	
Nickel, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	
Selenium, Total	6010B	ND U	mg/Kg	0.50	1	04/21/16 20:54	04/21/16	